Am. J. Trop. Med. Hyg., 71(Suppl 2), 2004, pp. 162–167

PROVIDING PRACTICAL ESTIMATES OF MALARIA BURDEN FOR HEALTH PLANNERS IN RESOURCE-POOR COUNTRIES

IRENE AKUA AGYEPONG AND JANE KANGEYA-KAYONDA

Dangme West District Health Administration, Ghana Health Service, Dodowa, Ghana; Office of the Director General, World Health Organization, Geneva, Switzerland

Abstract. In many countries in sub-Saharan Africa, estimates of malaria occurrence used by health planners at all levels are based on data from formal sector health facilities. Since the majority of fever episodes are treated at home and within the community, the burden estimates obtained this way are the tips of the iceberg. A case study from Ghana comparing household data on acute morbidity and treatment-seeking behavior in two districts with health facility data is used as an illustration. For every case of febrile illness seen in the health facilities, there were approximately 4–5 in the community. Many sub-Saharan African countries recommend that all febrile episodes, especially in children, be treated with an antimalarial. Since several countries extend malaria treatment to include the community and the home through public and private, formal and informal sectors, the need for more comprehensive burden estimates becomes urgent.

INTRODUCTION

The major burden imposed by malaria on populations in sub-Saharan Africa is well recognized. A recent review[1] has again confirmed the repeated estimates of malaria deaths ranging between one and two million per year globally, with approximately 90% of these occurring in sub-Saharan Africa, and primarily affecting children less than five years of age. While these estimates help to quantify the burden to assess its impact on the health system and to make reasonable estimates of the necessary resources for treatment and prevention, they probably fall short of the real burden. As Breman[2] accurately summarizes, the burden of malaria is a challenge to quantify given that infections cover a wide continuum from asymptomatic parasitemia in partially immune persons to acute catastrophic illness such as cerebral malaria that often lead to death. Second, malaria case detection and reporting are often incomplete for several reasons. Surveillance and diagnostic systems are weak in many parts of Africa where malaria takes its highest toll. Many febrile illnesses in endemic countries mimic malaria and parasitologic confirmation of diagnosis is often either not available or unreliable. Most diagnosis whether in clinics or at home is presumptive and is probably more accurately described as "febrile illness presumed malaria" rather than conclusively as malaria.

All this is further complicated by the fact that in many if not all countries in Africa and other parts of the developing world, most morbidity, including fever episodes are treated at home and within the community in informal health services and networks. They never become visible to the formal health system and thus registered by the health management information system (HMIS) and routine surveillance systems. For example Kloos and others[3] in a study in Ethiopia found that only one-third of all illness in the population they studied was treated by the modern health services. Almost 20% was treated by self care, 26% by traditional medicine and transitional healers, and as many as 21.5% were not treated at all. In a study in three districts in different regions of Ghana, Asenso-Okyere and others[4] found that self medication was the first choice of treatment in 65.8% of the children, 69.1% of the adult males, and 58.9% of the adult females when they contracted mild fever. Even in the case of babies, 57% were given home treatment as a first choice by their mothers or other principal caretaker. Chawla and Ellis[5] in a community based study in Niger reported illness among 20% of the population over the period of the study, but only 2.7% of the population reported seeking formal sector care. This implies that formal services were used by only about 14% of the individuals reporting morbidity. Mugisha and others[6] in a study in Burkina Faso found that regardless of the illness in question, a substantial number of patients (81.2% for malaria and 64.3% for all other illnesses) choose self treatment.

This high use of home and community based treatment rather than the formal health services is mirrored in the under use of formal sector services in many parts of Africa. Kloos[7] reported overall primary care clinic use rates between 4 and 37 per 100 population for health centers and health stations studied in Ethiopia. Although still low, hospital use rates were somewhat higher, as were use rates for people living nearer the clinics. Walker and Gish[8] reported outpatient use rates in Botswana of 110/100 population or 1.1 per capita overall with use rates of 61/100 for new cases only and 49/100 for repeat visits. In a recent review of Ghana's first five-year program of work, the observation was made that public sector outpatient department use rates per capita for the country remained very low over the period, varying from 30 per 100 in 1996 to 36 per 100 in 2000.[9]

Health planners can be defined as people all levels of health systems who plan for and monitor and evaluate resources and programs that are needed for effective health delivery, including malaria control in a given country context. Examples of health planners in this definition include malaria control program managers; district directors of health services or district medical officers; national, regional, or provincial and district level managers of essential drugs programs, etc.

Estimates of malaria occurrence used by health planners in sub-Saharan Africa to help quantify the malaria burden to assess its impact on the health system and make reasonable estimates of the necessary resources for treatment and prevention often depend on routine HMIS data and surveillance reports from the formal sector health services. Given the well-documented limited use of these services by the population, estimates of the burden that is obtained from such data reflect only the tip of the iceberg or in the words of Breman[2] "the ears of the hippopotamus." Until routine HMIS and surveillance reports become much more comprehensive than they are now, estimating the real extent and burden of malaria

requires periodic simple household surveys to provide more information about what is actually happening in the community to supplement routine HMIS data and surveillance reports.

Second, given the already described difficulties of diagnosis as well as the weakness of diagnostic systems, in many parts of Africa, working estimates of the burden of malaria whether through the HMIS, surveillance reports, or household and community-based data will for most practical purposes have to be estimates of the burden of "febrile illness presumed malaria."

In this report, a case study from a rural district in Ghana is used to illustrate the wide difference between estimates of the burden of "febrile illness presumed malaria" based on routine HMIS data and that supplemented by community-based data on morbidity and health-seeking behavior of communities and household.

CASE STUDY

Background on the study area. As in much of sub-Saharan Africa, malaria has been and remains a major cause of morbidity and mortality in Ghana. It regularly accounts for approximately 30–50% of all reported outpatient attendances. The diagnosis and treatment at health facility level in most cases is presumptive due to limited or non-available laboratory facilities.

Cross-sectional data was collected at household level in February/March 1994 and October 1997 on acute morbidity and treatment-seeking behavior over a two-week recall period in two districts in southern Ghana.[10] Morbidity was defined as morbidity that started within the two weeks before the date of interview. Morbidity existing before this 14-day period was excluded. The Dangme West and East districts where the data were collected are purely rural districts. There were no hospitals or laboratory services in both districts at the time of the study. All formal sector services were provided through rural health centers and community clinics and all diagnosis of malaria was presumptive. This situation is not uncommon in other districts whether in Ghana or other parts of Africa. Rural health centers and community clinics provide primary outpatient care and are staffed by professional and auxiliary nurses.

Malaria epidemiologic studies in the Dangme West district between 1992 and 1994 by the Noguchi Institute for Medical Research[11] found that malaria transmission occurred year round, but with more pronounced seasonal variation in the coastal savannah area compared with the more inland forest-like areas. Peak parasite rates occurred in those 5–9 years old, with a high of 68% in this age group in the forest area and 43.9% in the savannah area. Most of the morbidity occurred in the children less than five years old.

METHODS

The data were collected using a close-ended questionnaire. Informed consent was obtained from the participants by the interviewer. Thirty clusters were selected in each district using as a sampling frame a list of communities in the district with their populations derived from the 1984 census. Within each of the clusters, 7–10 households were selected at random by locating the approximate center of the cluster, spinning a pen, and setting out and continuing in the direction the tip of the pen came to rest in until the 7–10 households had been obtained. The study was reviewed and approved by the Director of the Health Research Unit or the Director of Medical Services.

The data were entered and analyzed mainly in Epi-Info (Centers for Disease Control and Prevention, Atlanta, GA) but also in Stata (Stata Corp., College Station, TX). To make deductions about the actual burden of febrile illness presumed malaria, the household data from one of the districts, Dangme West, were compared with data from an analysis of routine HMIS data over time on general outpatient attendance and outpatient attendance diagnosed as malaria.

RESULTS

Febrile illness presumed to be malaria from household survey. Table 1 summarizes the background for household members reporting morbidity in the two weeks preceding each of the surveys in the two districts. As shown in Table 1, 6.9% of the population in Dangme West and 8.5% in Dangme East reported acute morbidity within the two weeks preceding the survey in February /March 1994. In October 1997, the figures were similar at 6.9% in Dangme West and 8.9% in Dangme East.

Table 2 summarizes the symptoms and signs presented for all reported morbidity. "Hot body" or fever was the major complaint, with 85% of those reporting morbidity in the 1994 survey and 86% of those reporting morbidity in the 1997

TABLE 1

Background variables on households surveyed and for those reporting morbidity in the two weeks preceding the date of interview by district

	February/March 1994		October 1997	
	Dangme West	Dangme East	Dangme West	Dangme East
Number households in sample	300	309	300	300
Total number of individuals	1,804	2,028	1,721	1,893
Household size				
Mean (SD)	6 (3.2)	7 (3.4)	6 (3.3)	6 (3.5)
Median	5	6	5	6
Range	1–27	1–27	1–21	1–20
Number individuals reporting acute morbidity	125	173	119	168
Percentage of individuals reporting acute morbidity	6.9	8.5	6.9	8.9
No. of individuals with home diagnosis approximating to 'febrile illness presumed malaria'	73	95	81	104
Percentage of individuals with home diagnosis of 'febrile illness presumed malaria' morbidity over the two week period	4.0	4.7	4.7	4.9
Background variables for those reporting morbidity				
Average age in years	17	17	22	25
% children 0–4 years old	34	35	28	20
% Males	44	49	35	46
% Females	56	51	65	54
Start of illness 0–7 days ago	52	49	51	49
Start of illness 8–14 days ago	48	51	49	51
Still ill at time of survey	45	46	53	49

TABLE 2
Symptoms and signs presented for all morbidity

Sign/symptom	February/March 1994 Percentage complaining			October 1997 Percentage complaining		
	West	East	Both districts	West	East	Both districts
Hotness of the body	86	87	86	84	86	85
Headache	58	63	61	61	74	69
Chills	49	63	57	59	66	63
General weakness	45	44	44	46	57	53
Yellow urine	42	43	43	50	46	48
Profuse sweating	42	45	44	44	49	47
Bitterness of the mouth	41	43	42	51	54	53
General bodily aches and pains	37	46	42	52	65	60
Cough	30	31	30	34	38	36
Yellow eyes	29	29	29	31	31	31
Vomiting	28	41	36	27	29	28
Abdominal pain	24	34	30	37	45	41
Diarrhea	19	33	27	29	31	30
Change in consciousness*	12	18	16	15	21	19
Coca cola urine†	10	12	11	14	13	14
Convulsions in children	4	3	3	3	4	3
Cold sores around mouth	4	9	7	4	11	8
Others‡	26	23	24	21	21	21
Sample size (n)	107	173	298	100	168	287

* Includes drowsiness, delirum, coma, etc.
† A sign of severe intravascular haemolysis. The urine is a dark brown-black rather like coca cola or black tea.
‡ Blood in the stool, blood in the urine, boils, sleeplessness, cold, constipation, cries excessively, injury, bleeding gums, painful eyes, heart burn, loss of appetite, loss of weight, menstural problems, waist pains, toothache, palpitations, scabies, sore throat, 'anemia', bloated stomach, brown eyes, difficulty in breathing, dizziness, ear problems, 'heart pains', looks pale, neck pains, ear ache, pains in the legs, dysuria, skin rashes, sore stomach, sore mouth, spots on the body, and weight loss.

TABLE 4
Symptoms and signs presented by cases with presumed malaria home diagnosis

Sign/symptom	February/March 1994			October 1997		
	West	East	Total	West	East	Total
Hotness of the body	94%	89%	91%			
Headache	68%	73%	71%			
Chills	56%	65%	61%			
General weakness	45%	44%	44%	46%	57%	53%
Yellow urine	42%	43%	43%	50%	46%	48%
Profuse sweating	42%	45%	44%	44%	49%	47%
Bitterness of the mouth	41%	43%	42%	51%	54%	53%
General bodily aches and pains	37%	46%	42%	52%	65%	60%
Cough	30%	31%	30%	34%	38%	36%
Yellow eyes	29%	29%	29%	31%	31%	31%
Vomiting	28%	41%	36%	27%	29%	28%
Abdominal pain	24%	34%	30%	37%	45%	41%
Diarrhea	19%	33%	27%	29%	31%	30%
Change in consciousness*	12%	18%	16%	15%	21%	19%
Coca cola urine†	10%	12%	11%	14%	13%	14%
Convulsions in children	4%	3%	3%	3%	4%	3%
Cold sores around mouth	4%	9%	7%	4%	11%	8%
Others‡	26%	23%	24%	21%	21%	21%
Sample size (n)	73	95	168	81	104	185

* Includes drowsiness, delirum, coma, etc.
† A sign of severe intravascular hemolysis. The urine is a dark brown-black rather like coca cola or black tea.
‡ Blood in the stool, blood in the urine, boils, sleeplessness, cold, constipation, cries excessively, injury, bleeding gums, painful eyes, heart burn, loss of appetite, loss of weight, menstural problems, waist pains, toothache, palpitations, scabies, sore throat, 'anemia', bloated stomach, brown eyes, difficulty in breathing, dizziness, ear problems, 'heart pains', looks pale, neck pains, ear ache, pains in the legs, dysuria, skin rashes, sore stomach, sore mouth, spots on the body, and weight loss.

survey complaining of it. Although not all fever is malaria, malaria is the major fever in the study area. Table 3 summarizes the diagnosis for sick people within the household. Earlier social science work on community terminology and concepts related to fevers and malaria among the Adangme[12–14] suggests that a household level diagnosis of "fever, atridie, asra," or malaria in the Dangme area can be approximated to a household level diagnosis of "febrile illness presumed malaria." Thus, at the household level in the two districts in 1994 as well as 1997, 55% or more of all morbidity can be classified as having received a household level diagnosis of "febrile illness presumed malaria." This implies that 4–5% of the population in all surveys complained of morbidity occurring within the two weeks that was given a home diagnosis of "febrile illness presumed malaria."

Table 4 summarizes the symptoms and signs of those who were diagnosed within the household as "febrile illness presumed malaria." This data is very similar to that in Table 2. Table 5 and Figure 1 summarize the first action taken for all morbidity, and Table 6 and Figure 2 summarize the first action taken for morbidity that was classified at home as "febrile illness presumed malaria." There was no real difference in the first action taken for all morbidity or for "febrile illness presumed malaria" morbidity. In 50% or more of the cases of illness, whether or not presumed malaria," the first thing done was treatment within the household. The case was not taken to the formal health services. In another 20–25% of the cases, the first thing done was consultation of a community-based drug seller or non-formal sector provider. Only about 10–20% of the households contacted the formal sector health

TABLE 3
Household level diagnosis

	February/March 1994			October 1997		
	West	East	Both	West	East	Both
Fever	37%	34%	36%	41%	42%	42%
Atridie	6%	0%	3%	7%	3%	5%
Asra	7%	19%	13%	12%	15%	14%
Malaria	9%	3%	6%	9%	2%	6%
Total 'febrile illness presumed malaria'*	73 (58%)	95 (55%)	168 (57%)	81 (69%)	104 (62%)	185 (65%)
Others†	33 (26%)	27 (16%)	60	22 (19%)	18 (11%)	40
Don't know	19 (15%)	50 (29%)	69	15 (13%)	46 (27%)	61
No. reporting morbidity	125	172	297	118	168	286

* Diagnosis of fever, atridie, asra, or malaria made.
† Other illnesses were abdominal pains, catarrh/cold, convulsions, cough, diarrhea, headache, hedodoi, hernia, bilharzia, hot body, loss of blood, measles, mild convulsions, owede, pains in the neck, rheumatism, severe menstural problems, shortage of blood, sore in the mouth, stomach sore, waist pains, worms, and wounded.

TABLE 5
First action taken for all morbidity

Action	February/March 1994		October 1997	
	West	East	West	East
Treatment by family member	45 (38%)	55 (34%)	31%	24%
Treat self	18 (15%)	16%	21%	34%
Total within household treatment* (home)	53%	50%	52%	58%
Consult drug peddler	5%	7.5%	4.5%	4%
Consult chemical seller	14%	9%	18%	20%
Consult small shop owner	1%	1%	1%	1%
Consult injectionist	0%	1%	1%	1%
Total community based drug seller consultation†	20%	18.5%	24.5%	26%
Go to a health post/small clinic	12%	17%	9%	7%
Go to a hospital	9%	6%	8%	3%
Consult traditional healer‡	1%	4.5%	2%	4%
Other (specify)	4%	4%	3%	5.5%
Sample size (n)	118	161	110	151

* Treatment by family member plus self treat.
† Consult drug peddler, chemical seller, small shop owner, or injectionist.
‡ Traditional birth attendent, herbalist, spiritualist.

services as their first response to morbidity, whatever the diagnosis made at the household level. This first action taken was adequate for approximately 75% of all morbidity, and only approximately 25% of sick persons took a second action or had a second action taken on their behalf (Table 7). Even though a higher proportion of persons within the group that took a second action consulted the formal sector health service than for the first action taken, the numbers are still small.

Febrile illness presumed to be malaria from routine HMIS data in Dangme West. Since there are no hospitals in the Dangme West district, people in the district who decided to go to the hospital used one of several hospitals surrounding the district. Therefore, the data on their use of hospital services is captured in the data for the district in which the hospital visited is located. Thus, the routine HMIS data from the district is for outpatient care of malaria in health centers and community clinics and does not capture hospital use. However, the low hospital use recorded from the household data suggests that it is the smaller rather than the larger proportion of public sector facility use that is not captured by the district HMIS data. Table 8 summarizes routine HMIS data from the Dangme West district over the period 1992–2002, showing the reported cases of all morbidity, the reported cases of malaria, and what proportion of all morbidity was due to malaria. Figure 3 summarizes the trends in per capita attendance for new cases of all morbidity, as well as new cases diagnosed as malaria. The data shows under use of public sector biomedical facilities with the highest recorded attendance per capita being 0.38 (38 per 100) in 2002. There is a trend towards slowly increasing use as well as an increasing proportion of cases being diagnosed as malaria. The reasons for the increasing proportion of cases diagnosed as malaria are uncertain.

What is the true burden of febrile illness presumed to be malaria in the district? Given that the household data suggests that for every case of "febrile illness presumed malaria" seen at the formal health system level, there are approximately 4–5 others who never get seen and registered. The seventh column in Table 7 is an estimation of the probable total number of malaria cases that occurred in the year under

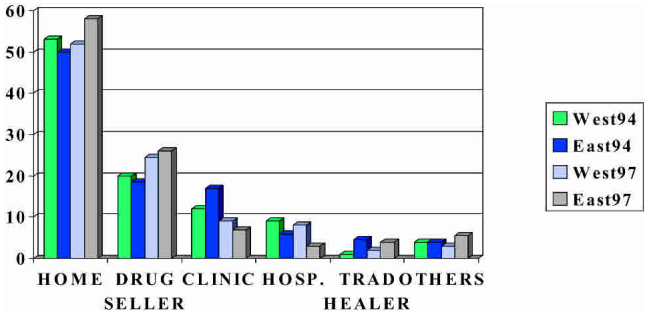

FIGURE 1. First action taken for all morbidity in Ghana. HOSP. = hospital; TRAD = traditional.

TABLE 6
First action taken for presumed malaria home diagnosis cases

Action	February/March 1994		October 1997	
	West	East	West	East
Treatment by family member	34%	38%	26%	25%
Treat self	14%	17%	22%	38%
Total within household treatment* (home)	48%	55%	48%	63%
Consult drug peddler	4%	11%	7%	3%
Consult chemical seller	14%	8%	22%	16%
Consult small shop owner	1%	0%	0%	1%
Consult injectionist	0%	1%	1%	1%
Total community based drug seller consultation†	19%	20%	30%	21%
Go to a health post/small clinic	16%	16%	10%	9%
Go to a hospital	11%	5%	5%	0%
Consult traditional healer‡	0%	1%	1%	3%
Other (specify)	4%	3%	5%	4%
Sample size (n)	70	93	77	94

* Treatment by family member plus treat self.
† Consult drug peddler, chemical seller, small shop owner, or injectionist.
‡ Traditional birth attendent, herbalist, spiritualist.

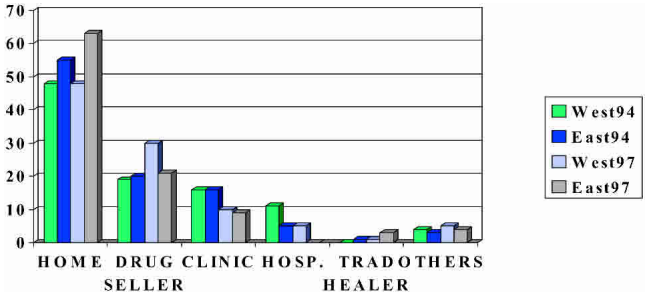

FIGURE 2. First action taken for "febrile illness presumed malaria" home diagnosis in Ghana. HOSP. = hospital; TRAD = traditional.

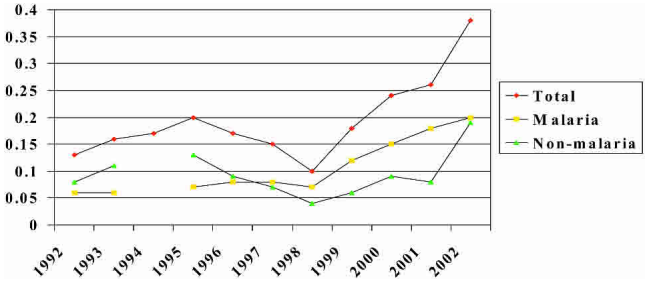

FIGURE 3. Attendance (new cases) per capita for malaria and non-malaria cases over time in Dangme West, Ghana.

TABLE 7
Second action taken for morbidity (total number taking a given action)

Treatment by	February/March 1994			October 1997		
	West	East	Total	West	East	Total
Family member/relative	4	12	16	4	1	5
Self	3	6	9	2	2	4
Traditional healer	0	1	1	3	1	4
Drug peddler	0	2	2	0	0	0
Chemical seller	0	3	3	0	1	1
Health post	10	14	24	3	7	10
Hospital	1	3	4	2	7	9
Other*	3	1	4	2	8	10
Sample size (n)†	21	43	64	16	27	43

* Pre-intervention in Dangme West 2 people was consultation with a community clinic attendant. What the third person did is unknown. In Dangme East what the person did is unknown.
Post intervention 1 person consulted an injectionist in Dangme East.
† Two missing responses in Dangme West.

review.* This would be the estimate of malaria occurrence a planner at the district level such as the District Director of Health services should more reasonably use in planning for malaria control in the district rather than the actual number of cases seen and recorded (fourth column in Table 7) by the HMIS.

Implications for public health. At the community and home levels, the burden of febrile illness presumed to be malaria is very high. The cases presenting at formal sector health facilities only represent the tip of the iceberg or the ears of the hippopotamus and underestimates the real burden. The community-based data from the case study suggesting that for every case seen in the formal sector health facilities there are four or five others in the community is similar to observations from other regions that the bulk of febrile and other morbidity is managed at home and within the community.[3,4] The severe under use of services in the study area further confirms the fact that much morbidity is not registering with the formal sector health services. Under use of formal sector services has also been recorded elsewhere in Africa.[5,7,8]

While there is a risk of overestimation of the burden, routine HMIS data regularly used for planning purposes is grossly underestimating the burden of "febrile illness presumed malaria" in many countries of Africa. Most sub-Saharan countries recommend that all febrile episodes especially in children be treated with an antimalarial. This has implications for planning for obtaining and distributing adequately logistics such as drugs and other supplies as well as support for program management. Since several countries start to plan extending malaria treatment to include the community and the home through both the public and the private formal and informal sectors, the need for more comprehensive burden estimates becomes urgent.

This is compounded by the increasing failure of chloroquine as the first-line antimalarial drug all across Africa and the need to move onto other alternative antimalarial drugs as first-line treatments.[15,16] Most alternative drugs are more expensive than chloroquine and do not have the advantage of long-term experience in use and through knowledge and familiarity with correct prescribing, side effects, etc. that chloroquine has acquired through long use.

The need to use simple community-based data on illness occurrence and care-seeking behavior to periodically supplement routine HMIS data used for planning in sub-Saharan Africa is urgent. An objection sometimes raised to the regular use of community-based data is that surveys are expensive and require special expertise. The health systems of most countries in the region are severely resource constrained. However, the methodology used to gather the community-based data described here was a very simple and fairly inexpensive rapid appraisal. Moreover, it can be simplified further, and the essential data needed to inform planners can probably be captured on a simple one- or at most two-page questionnaire that could even be manually analyzed if need

*The calculation is based on the estimate that if only 16% of the "febrile illness presumed malaria" cases used a health post or a small clinic as their treatment choice (Table 6), then for every 16 cases recorded by the routine HMIS, there are 84 other cases in the community that are not recorded. Thus, the number of cases of "febrile illness presumed malaria" actually occurring in the year would more likely be [(Total new cases recorded at the health centers) × (100/16)].

TABLE 8
Routine health management information system data on outpatient department attendance and malaria over time from the Dangme West District

A	B	C	D	E	F	G	H	I	J	K
Year	District population	Total new cases seen at primary care clinics	Cases diagnosed as malaria	Proportion of all cases diagnosed as malaria	Attendance per capita	Malaria attendance per capita	Estimated no. of presumed malaria cases in the community*	Estimated no. of presumed malaria cases per capita	Non malaria cases	Non malaria attendance per capita
1992	90,733	12,123	5,285	0.44	0.13	0.06	33,031	0.36	6,838	0.08
1993	93,092	15,335	5,285	0.34	0.16	0.06	33,031	0.35	10,050	0.11
1994	94,444	16,499	–	–	0.17	–	–	–	–	–
1995	97,285	19,747	7,272	0.37	0.20	0.07	45,450	0.47	12,475	0.13
1996	100,210	17,466	8,079	0.46	0.17	0.08	50,494	0.50	9,387	0.09
1997	103,210	15,598	8,136	0.52	0.15	0.08	50,850	0.49	7,462	0.07
1998	106,307	10,934	7,098	0.65	0.10	0.07	44,363	0.42	3,836	0.04
1999	109,497	19,679	12,810	0.65	0.18	0.12	80,063	0.73	6,869	0.06
2000†	96,015	22,822	14,404	0.63	0.24	0.15	90,025	0.94	8,418	0.09
2001	98,319	25,603	17,675	0.69	0.26	0.18	110,469	1.12	7,928	0.08
2002	104,650	39,811	20,413	0.51	0.38	0.20	127,581	1.22	19,398	0.19

* From the household survey, only 16% of presumed malaria home diagnosis goes to a formal sector primary care facility in the district as a first choice. Thus, for every case of malaria registered at the health facilities, there are probably about six cases in the community that did not get seen there and will not register with the routine health management information/surveillance system.
† National census in 2000 gave the district population as 96,015. The population figures from 1992 to 1999 are based on projections from the 1984 national census. The 2001 and 2002 figures have been projected from the 2000 census using the growth rate for the Greater Accra region of which the district is a part.

be. Furthermore, this kind of data does not need to be collected every year if resources are really constrained. Even collecting such data as infrequently as once every five years or so and using it to fine tune information from the routine HMIS would still be better than nothing. Last but not least, the value of using some resources in a particular way must not be appraised in terms of absolute cost alone, but in terms of the value obtained for spending a given amount. The cost of inefficient planning due to poor basic data on disease occurrence if properly evaluated may actually be more than the extra cost introduced by periodic simple surveys to improve planning data.

There is no reason why a program such as Roll Back Malaria cannot assist health planners in the countries of sub-Saharan Africa to have a standardized, simple, rapid appraisal tool that can be used fairly inexpensively at all levels of the health system to periodically refine the accuracy of the information on "febrile illness presumed malaria" being used for planning.

Received August 21, 2003. Accepted for publication October 7, 2003.

Acknowledgments: Some of the data in this report on community-based acute morbidity and treatment-seeking behavior was part of a larger study (Integrating Health Education into Malaria Control at District Level).

Financial support: This study was supported by the United Nations Development Program/World Bank/World Health Organization Special Program for Research and Training in Tropical Diseases.

Authors' addresses: Irene Akua Agyepong, Regional Health Administration, Ghana Health Service, Greater Accra Region, P.O. Box 184, Adabraka, Ghana. E-mail: iagyepong@ighmail.com. Jane Kangeya-Kayonda, The UNICEF/UNDP/World Bank/WHO Special Program for Research and Training in Tropical Diseases, World Health Organization, Geneva, Switzerland.

REFERENCES

1. Snow RW, Craig M, Deichmann U, Marsh K, 1999. Estimating mortality, morbidity, and disability due to malaria among Africa's non pregnant population. *Bull World Health Organ 77:* 624–640.
2. Breman JG, 2001. The ears of the hippopotamus: manifestations, determinants, and estimates of the malaria burden. *Am J Trop Med Hyg 64 (suppl):* 1–11.
3. Kloos H, Etea A, Degefa A, Aga H, Solomon B, Abera K, Abegaz A, Belemo G, 1987. Illness and health behaviour in Addis Ababa and rural central Ethiopia. *Soc Sci Med 25:* 1003–1019.
4. Asenso-Okyere WK, Anum A, Osei-Akoto I, Adukonu A, 1998. Cost recovery in Ghana: are there changes in health care seeking behaviour? *Health Policy Plann 13:* 181–188.
5. Chawla M, Eellis R, 2000. The impact of financing and quality changes on health care demand in Niger. *Health Policy Plann 15:* 76–84.
6. Mugisha F, Kouyate B, Gbangou A, Sauerborn R, 2002. Examining out of pocket expenditure on health care in Nouna, Burkina Faso: implications for health policy. *Trop Med Int Health 7:* 18–196.
7. Kloos H, 1990. Utilization of selected hospitals, health centres and health stations in central, southern and western Ethiopia. *Soc Sci Med 31:* 101–114.
8. Walker G, Gish O, 1977. Inequality in the distribution and differential utilization of health services: a Botswana case study. *J Trop Med Hyg 80:* 238–243.
9. Ministry of Health Ghana, 2000. *Health of the Nation*. Accra, Ghana, Ministry of Health.
10. Agyepong IA, Aryee B, Asiedu A, Owusu G, Wellington E, 1998. *Integrating Health Education into Malaria Control at the District Level.* Accra, Ghana: Ministry of Health.
11. Afari EA, Dunyo SK, Koram KA, Nkrumah FK, 1992. *Epidemiology of Malaria with Special Emphasis on Transmission, Morbidity, Mortality and Disease Control in Ghana. Part 1. Malaria Transmission, Morbidity and Mortality in Coastal Savanna and Forest Areas in Southern Ghana.* Legon: Ghana: Noguchi Memorial Institute for Medical Research. University of Ghana.
12. Agyepong IA, 1992. Malaria: ethnomedical perceptions and practice in an Adangme farming community and implications for control. *Soc Sci Med 35:* 131–137.
13. Agyepong IA, Manderson L, 1994. The diagnosis and management of fever at household level in the greater Accra region, Ghana. *Acta Trop 58:* 317–330.
14. Agyepong IA, Wellington E, Ablordey AM, 1997. A comparative study of clinical and sociocultural aspects of anaemia among adolescent girls in rural Ghana. *Acta Trop 65:* 123–138.
15. Warsame M, Abdillahi A, Duale ON, Ismail AN, Hassan AM, Mohamed A, Warsame A, 2002. Therapeutic efficacy of chloroquine and sulfadoxine/pyrimethamine against *Plasmodium falciparum* infection in Somalia. *Bull World Health Organ 80:* 704–708.
16. Shretta R, Omumbo J, Rapuoda B, Snow RW, 2000. Using evidence to change antimalarial drug policy in Kenya. *Trop Med Int Health 5:* 755–764.